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Date: December 11, 2007

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Docket No: H1559

In re patent application of:

Appellants:	Adam Pawloski, et al.	Art Unit:	1756
Serial No.:	10/790,457	Examiner:	Caleen O. Sullivan
Filing Date:	01 March 2004	Confirmation No.	9956
For:	METHOD FOR REMOVAL OF IMMERSION LITHOGRAPHY MEDIUM IN IMMERSION LITHOGRAPHY PROCESSES		

REPLY BRIEF

VIA EFS
M/S Appeal Briefs - Patents
Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313

Dear Sir:

This Reply Brief is submitted in the above-identified application in response to the Examiner's Answer mailed 26 November 2007. Accordingly, Appellants' Reply Brief is timely filed, with no extension of time.

APPELLANTS' ARGUMENT IN RESPONSE TO EXAMINER'S ANSWER

In compliance with 37 C.F.R. §41.41, Appellants' response to the Examiner's arguments with respect to the rejections presented for review follows.

As described in the claims, and described in detail in the specification, the claimed process provides a process for fabricating a semiconductor device including the use of immersion lithography, in which the immersion lithography fluid is applied to a surface, the surface and the fluid are exposed to electromagnetic radiation of a desired wavelength, and then the immersion lithography fluid, together with any debris or other reaction products, is removed by use of supercritical carbon dioxide. The mixture of supercritical carbon dioxide and lithography medium is then recovered, purified, and in some embodiments, re-used in the same process.

The present invention addresses problems resulting from use of expensive immersion lithography fluids in immersion lithography processes, and avoids the need to dispose of the immersion lithography fluids after use. The invention also addresses the problem of removal of the immersion lithography fluid together with any debris or other reaction products or byproducts from the surface of a nascent semiconductor device while avoiding the many pitfalls involved in prior art cleaning materials, by the use of the supercritical carbon dioxide.

Thus, the present invention responds to the need in the art for a semiconductor fabricating process that is efficient, clean and non-contaminating to the nascent semiconductor device, is both economically and environmentally favorable, and is relatively simple and straightforward to carry out.

A. Appellants' Claims 1-6, 8-13, 15-21 and 23 Would Not Have Been Obvious over Switkes et al., in View of Wallace, U.S. Patent 6,024,801 and Further in View of Constantini et al., U.S. Patent 6,612,317, Because the Combined References Fail to Teach All the Claimed Features.

Claims 1-6, 8-13, 15-21 and 23 stand rejected as obvious over the asserted combination of Switkes et al. ("Immersion Lithography at 157 nm"), Wallace, U.S. Patent No. 6,024,801 and Constantini et al., U.S. Patent No. 6,612,317. Appellants respectfully traverse these rejections for at least the following reasons, and request the Board to reverse the rejection of the claims over the asserted combinations of these references.

As noted in Appellants' opening Brief, Section 103 states that an invention is unpatentable for obviousness "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a *whole* would have been obvious...." In rejecting claims as unpatentable for obviousness, the Examiner must show that the claimed invention as a *whole* would have been obvious. This requires more than a mere suggestion (or less) of various parts of the claimed invention in the prior art and requires more than a conjectural contention that a reference "suggests" something that is nowhere mentioned or in any way suggested in the reference. Because, even if the other references teach everything contended by the Examiner, Constantini fails to disclose or fairly suggest recovery and recycling of an immersion lithography fluid, Appellants respectfully submit that the Examiner has failed to make such a showing and therefore there can be no *prima facie* obviousness in the present case.

Specifically, although Switkes et al. and Wallace and Constantini et al., if combined, disclose some of the features of the presently claimed invention, these references fail to disclose or suggest all of the claimed features as recited in Appellants' claims. Specifically, the combination fails to disclose recovering and purifying, and/or recovering, purifying and recycling for reuse in immersion lithography, an immersion lithography fluid, as claimed.

Switkes et al. relates to immersion lithography at 157 nm. As admitted by the Examiner, Switkes et al. fails to disclose (or suggest) a step of applying a supercritical

carbon dioxide to the wafer to remove the immersion lithography medium from the wafer. In fact, Switkes et al. fails to address in any way the removal of the immersion lithography fluid from the wafer. In addition, Switkes et al. not only fails to disclose or suggest anything about removing the immersion lithography fluid, but Switkes et al. fails to suggest any possible need for recovering or purifying the immersion lithography fluid.

Wallace relates to use of supercritical fluids such as carbon dioxide to remove substances from a nascent semiconductor wafer, retaining the wafer in the chamber in which the supercritical fluid was applied and then passivating the surface, prior to exposure to atmospheric air. Wallace has nothing whatsoever to do with immersion lithography. Wallace does not even mention lithography, of any kind. Wallace is completely irrelevant to the present invention except for its use of supercritical carbon dioxide to clean a surface.

The use of Constantini et al. is inapt because even though Constantini et al. refers to recovery of carbon dioxide and, possibly, a co-solvent applied together with the carbon dioxide, there is nothing whatsoever in Constantini et al. that would suggest recovery or purification or reuse of any material removed from the surface of the wafer being treated. Constantini et al. is concerned with making semiconductor process steps continuous, to obtain steady-state operation. The only materials recovered by Constantini et al. are the carbon dioxide and any optional co-solvent and/or surfactant added to the carbon dioxide to assist in removal of "impurities, solute, solvent, water, or other contamination, dirt, or particles" (col. 4, lines 65-66).

If the wafers under treatment by Constantini et al. included an immersion lithography fluid, that fluid would be removed for disposal in the liquid phase referred to as waste at col. 6, lines 55-56. There is not a word in Constantini et al. to suggest the recovery and reuse of any of the components of the waste. At col. 6, from line 7 to line 67, Constantini et al. discloses the post-cleaning portion of the process. Initially, the mixture of supercritical fluid, together with suspended or dissolved components, now called "effluent", is discharged from the process chamber to a separator (lines 11-18), where the mixture is cooled and its

pressure reduced to below-critical levels, where the mixture separates into a vapor phase and a liquid phase (lines 21-28). The vapor phase contains the gas (e.g., carbon dioxide) and possibly a small fraction of any co-solvent or dissolved liquid or solid from the wafer (lines 29-32). The liquid phase contains the co-solvent (which was originally added with the carbon dioxide) and any dissolved or suspended components removed in the process chamber (lines 40-44). The liquid phase passes into a separator, where the co-solvent is boiled off, and a liquid phase, now called "waste", which contains any remaining contamination remains, which is discharged to a holding tank, which is removed for disposal or recovery of its contents (lines 48-62).

The "recovery" mentioned at col. 6, line 61, of Constantini et al. is the only possible source of any "suggestion" to recover any component of the waste removed from the supercritical treatment chamber. Appellants submit that, in the absence of improper hindsight reconstruction of Appellants' claimed invention, this disclosure is wholly inadequate to support the rejection of Appellants' claims.

Furthermore, even the mention of "recovery" includes or suggests nothing whatsoever about purification and reuse. This, coupled with the complete absence of any mention of a immersion lithography fluid, shows that there is no proper basis in Constantini et al. for the rejection of Appellants' claims, even in combination with Switkes et al. and Wallace et al.

It is most noteworthy that in constantini et al., only the co-solvent is removed at "suitable purity to be re-used in the process". Any fair and appropriate reading of Constantini et al. would suggest, at best, that components of the waste that are not acceptable for disposal, e.g., for environmental reasons, should be "recovered", i.e., not simply disposed of. After describing in detail the disposition of the important components, with respect to any further handling of this waste, the process of Constantini et al. has reached a dead end. There is not one word to suggest that any particular waste component should or could be recovered, purified and reused, and there is not one word

to suggest that any component of the waste or any other part of the Constantini et al. process includes an immersion lithography fluid. Finally, there is not one word in Constantini et al., not even with the aid of hindsight, to suggest that any component of the process could include an immersion lithography fluid that could be purified for re-use, e.g., as an immersion lithography fluid.

Finally, if Constantini et al. had intended for a valuable component such as an immersion lithography fluid to be recovered, purified and re-used, the reference certainly would have so stated. The fact that it did not can mean only that such is beyond the teaching or any possible suggestion that can fairly be drawn from this reference in the absence of improper hindsight reconstruction of Appellants' invention.

To establish a *prima facie* case of obviousness, the Examiner must establish that *the prior art references teach or suggest all the claim limitations*. See MPEP 706.02(j)). If all the claim limitations are not found, then there can be no obviousness because the invention as a whole was not in the prior art.

In the present case, as shown above, the asserted combination of prior art references fail to teach or suggest all the claim limitations. Appellants' claims specify, inter alia, the step of recovering and purifying the immersion lithography fluid, and the cited references fail to disclose this feature of Appellants' claims. For this reason alone, there is no *prima facie* case of obviousness in the present case.

Failing to teach or suggest all the claim limitations, there can have been no motivation to combine the reference teachings. Failing to teach or suggest all the claim limitations and absent any motivation, there can have been no reasonable expectation of success.

Accordingly, Appellants submit that there is no *prima facie* case of obviousness in the present case. Appellants respectfully request the Board to reverse the Examiner's rejections of Appellants' presently pending claims over Switkes et al., Wallace and Constantini et al.

B. Claim 23 Would Not Have Been Obvious over the Combined References.

Claim 23 depends from claim 1 and states that the immersion lithography medium recovered from the mixture and purified exhibits substantially the same purity as the immersion lithography medium applied to the surface of the semiconductor wafer, and the process further comprises recycling the recovered and purified immersion lithography medium for use in immersion lithography. This claim extends the claimed invention to include purification to a degree sufficient that the recycled material can be used in the same way as the original material. Since, for the reasons set forth above, the combined prior art references fail to disclose the recovery and purification of the immersion lithography fluid, there simply can be no reasonable contention that the additional features of claim 23 were either disclosed or suggested in the prior art references cited and relied upon in rejection of Appellants' claims.

There is simply nothing in the combined references that could possibly support the rejection of claim 23. For this additional reason, claim 23 fully distinguishes over the prior art and the Board is requested to reverse the rejection thereof.

C. The Arguments of the Examiner in the Final Office Action and Advisory Action Are Based on Incorrect "Facts", an Overbroad Reading of the References and Do Not Credit All the Features of Appellants' Claims.

The Examiner's clearly erroneous reading of the prior art is the basis upon which the rejections stand. The Examiner's reading of the prior art references, in particular that of Constantini et al., is overly broad, and attributes disclosure or suggestion that is simply not present and not fairly found, in the absence of hindsight. The discussion in Constantini et al., as pointed out above in detail, applies only to the carbon dioxide and the co-solvent, and cannot apply to non-existent component, i.e., an immersion lithography fluid. There is no disclosure or suggestion that such a component could be recovered and reused. Every instance cited by the Examiner as allegedly teaching recovery and purification of the immersion lithography fluid actually applied to the co-solvent, which was added together with the supercritical fluid and was not something on the wafer surface. There is nothing

that fairly suggests the recovery and purification, and in some embodiments, re-use as if new, of the immersion lithography fluid. The only way such can be gleaned from Constantini et al. is by improper use of hindsight reconstruction based on Appellants' invention. Thus, the Examiner's reading of Constantini et al. is clearly erroneous and lacks support of substantial evidence.

Finally, Appellants respectfully submit that the foregoing obviousness contentions in the Office Actions in this case are based on an improper piecemeal analysis, one that can only have resulted from an improper hindsight reconstruction of Appellants' claimed invention. The Examiner failed to state a legally correct *prima facie* case of obviousness, since the Examiner failed to consider the claimed invention as a whole as is required by the law, the Rules of Practice and the MPEP.

Accordingly, Appellants request the Board to reverse the Examiner's rejection of Appellants' claims over the contended combination of references, none of which in any combination support a factually correct and legally proper *prima facie* case of obviousness.

IX. CONCLUSION

For all these reasons, the rejection of Appellants' claims 1-6, 8-13, 15-21 and 23 under 35 U.S.C. §103(a) should be reversed. Appellants respectfully request reversal of the Examiner's rejections of Appellants' claimed invention. Appellant respectfully submits that all of the pending claims are in condition for allowance, and respectfully request notice to such effect from the Examiner and/or the Board.

In the event issues remain in the prosecution of this application, Appellants request that the Examiner telephone the undersigned attorney to expedite further consideration and/or allowance of the claims of this application. Should a Petition for Extension of Time be necessary for the present Appeal Brief to be timely filed (or if such a petition has been made and an additional extension is necessary) petition therefor is hereby made and, if any additional fees are required for the filing of this paper, the Commissioner is authorized to charge those fees to Deposit Account #18-0988, Docket No. H1559, AMDSPH1559US.

Respectfully submitted,
RENNER, OTTO, BOISSELLE & SKLAR

Date: December 11, 2007

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